What is Claimed is

1. A method for forming an aluminum-containing interconnect structure, comprising:

providing a substrate having a contact region;

forming a first barrier layer on said substrate;

forming an aluminum-containing conductive layer on said first barrier layer;

forming a second barrier layer on said aluminum-containing conductive layer;

patterning said second barrier layer, said aluminum-containing conductive layer, and said first barrier layer to form an aluminum-containing interconnect, said aluminum-containing interconnect coupling said contact region and exposing a sidewall; and

forming a barrier spacer on said sidewall of said aluminum-containing interconnect.

2. The method of claim 1, wherein said contact region comprises a via contact region.

3. The method of claim 1, wherein said aluminum-containing conductive layer is selected from a group consisting of an aluminum layer, an aluminum alloy layer, and the combination thereof.

4. The method of claim 1, wherein said step of forming said first barrier layer comprises using a material selected from a group consisting of titanium, titanium nitride, and the combination thereof to form said first barrier layer.

5. The method of claim 1, wherein said step of forming said second barrier layer comprises using a material selected from a group consisting of titanium, titanium nitride, and the combination thereof to form said second barrier layer.

6. The method of claim 1, wherein said step of forming said aluminum-containing interconnect comprises:

forming a patterned photoresist layer on said second barrier layer, said patterned

photoresist layer defining said aluminum-containing interconnect;

etching said second barrier layer, said aluminum-containing conductive layer, and said first barrier layer by using said patterned photoresist layer as a mask; and

removing said patterned photoresist layer.

7. The method of claim 1, wherein said step of forming said barrier layer comprises:

forming a conformal barrier layer selected from a group consisting of titanium, titanium nitride, and the combination thereof on said aluminum-containing interconnect and said substrate; and

anisotropically etching said conformal barrier layer.

8. The method of claim 7, wherein said step of forming said conformal barrier layer comprises forming a titanium/titanium nitride or titanium nitride/titanium layer having a thickness about 300 Å, and when said titanium layer has a thickness in a range from 0 to 300 Å, said titanium nitride layer has a thickness in a range from 300 to 0 Å.

9. The method of claim 1, wherein said step of forming said conformal barrier layer comprises forming a titanium rich titanium nitride layer having an atom ratio of titanium to nitrogen larger than 1 (Ti/N>1).

10. A method for forming an aluminum-containing interconnect structure, comprising:

providing a substrate having a contact region;

forming a first barrier layer on said substrate;

forming an aluminum-containing conductive layer on said first barrier layer;

forming a second barrier layer on said aluminum-containing conductive layer;

patterning said second barrier layer, said aluminum-containing conductive layer, and said first barrier layer to form an aluminum-containing interconnect, said

aluminum-containing interconnect coupling said contact region and exposing a sidewall; and

forming a barrier spacer selected from a group consisting of titanium, titanium nitride, and the combination thereof on said sidewall of said aluminum-containing interconnect.

11. The method of claim 10, wherein said aluminum-containing conductive layer is selected from a group consisting of an aluminum layer, an aluminum alloy layer, and the combination thereof.

12. The method of claim 10, wherein said step of forming said first barrier layer comprises using a material selected from a group consisting of titanium, titanium nitride, and the combination thereof to form said first barrier layer.

13. The method of claim 10, wherein said step of forming said second barrier layer comprises using a material selected from a group consisting of titanium, titanium nitride, and the combination thereof to form said second barrier layer.

14. The method of claim 10, wherein said step of forming said aluminum-containing interconnect comprises:

forming a patterned photoresist layer on said second barrier layer, said patterned photoresist layer defining said aluminum-containing interconnect;

etching said second barrier layer, said aluminum-containing conductive layer, and said first barrier layer by using said patterned photoresist layer as a mask; and

removing said patterned photoresist layer.

15. The method of claim 10, wherein said step of forming said barrier layer comprises:

forming a conformal titanium/titanium nitride layer having a thickness of about 300 Å on said aluminum-containing interconnect and said substrate, wherein when said titanium layer has a thickness in a range from 0 to 300 Å, said titanium nitride

layer has a thickness in a range from 300 to 0 Å; and

anisotropically etching said conformal titanium/titanium nitride layer.

16. The method of claim 10, wherein said step of forming said barrier spacer comprises forming a titanium rich titanium nitride spacer having an atom ratio of titanium to nitrogen larger than 1 (Ti/N>1).